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FINAL REPORT

APPLICATIONS OF THE MÖSSBAUER EFFECT TO THE STUDY OF SOLIDS

by

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13. ABSTRACT

This report deals with the research accomplished under sponsorship of the Air Force Office of Scientific Research Grant Number AFOSR-69-1634 The principal areas of research were in the investigation of magnetic ordering in diluted magnetic materials and an investigation of heat transport in superconductors by the forced motion of normal regions induced by an external magnetic field.

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ABSTRACT

This report deals with the research accomplished under sponsorship of the Air Force Office of Scientific Research Grant Number AF64 6-64. The principal areas of research were in the investigation of magnetic ordering in diluted magnetic materials and an investigation of heat transport in superconductors by the forced motion of normal regions induced by an external magnetic field.

TECHNICAL

In the course of the development of the research funded under this grant, attention became concentrated in two areas.

1. Mössbauer studies of the magnetic or exchange interactions among magnetic impurities in non-magnetic hosts and;

2. The transport of heat in superconductors induced by the motion of non superconducting regions created by an applied magnetic field.

Development in both of these areas was satisfactory. A method of measuring magnetic interactions was successfully worked out and applied to the Iron-Palladium system. The complete method is described in publication number six. The technique thus described has been adopted by a number of investigators in other laboratories to the study of other magnetic systems. The phenomenon of heat transport in superconductors by the motion of normal regions has been fully understood and investigated in Type I superconductors. These results appear in publications number four and five and in the Master's degree thesis of Michiko Yoshihara. Heat transport by a similiar technique in Type II superconductors occurs by quite a different mechanism from that of Type I and was observed in our laboratory, however, this phenomenon has not yet been fully investigated. The ideas investigated here hold some promise of being useful in the development of a new method of producing low temperatures.

In addition, this grant has supported in part the work of Dr. Bernard Bertman* on ballistic heat pulses in solid helium. The principal results of this work are contained in publication number seven.

*deceased

PUBLICATIONS

1. JOURNAL
   The Range of Ferromagnetic Exchange Interaction in Nonmagnetic Films on Iron Substrates J. Appl. Phys. 36, 968-970
   1965

2. PROCEEDINGS
   Proceedings of the 10th International Conference on Low Temperature Physics, Temperature Dependence of the Magnetization of the Alloy Fe 13.2-Pd 86.8 Near the Curie Temperature
   1966

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   Transport of Heat in Superconducting Lead by Motion of a Magnetic Field, Bull. Am. Phys. Soc. 13, 76
   1968

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   Transport of Heat in a Type I Superconductor by a Moving Magnet Phys. Letter A 26, 295-296
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   Onset of Ballistic Temperature Pulses in Solid ^{4}He
   Phys. Rev. Letters 28, 16-18
   1972

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   Wesleyan University, Physics Department
   Richard A. Lindren, M. S. Degree
   Propagation of Conduction Electron Spin Polarization Through Metallic Surface Films, 1964

9. THESIS
   Wesleyan University, Physics Department
   Ekaterini Siafaca, M. S. Degree
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Wesleyan University, Physics Department
Michiko Yoshihara, M. S. Degree
Entropy Transport in Type-I and Type-II Superconductors
Associated with the Motion of Flux-Containing Normal Regions, 1970

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John Smith, M. S. Degree
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Philip Russell, B. S. Degree
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Michael L. Burack, B. S. Degree
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1964

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Wesleyan University, Physics Department
Michael D. Rosenthal, B. S. Degree
The Influence of a Current Density on the Effective Temperature
of Impurity Atoms Bound in a Metallic Lattice, 1965

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Bernard Bertman	Senior Investigator	
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Ekaterini S afaca	Master of Science	1968
Michiko Yoshihara	Master of Science	1970
John Smith	Master of Science	1970

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Michael Rosenthal	Bachelor of Science	1965
Roger Sivers	Bachelor of Science	1966